

**Journal of Endodontics, 1995, Vol. 21**

**MARCH**

**Col. Schindler, Chairman Of Endodontics  
59th MDW Dental Directorate  
Lackland AFB, TX**

**Articles:**

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**MARCH (Cont.)**

**Col. Schindler, Chairman Of Endodontics  
59th MDW Dental Directorate  
Lackland AFB, TX**

**Articles:**

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- **Coronal leakage and treatment failure**

## Bacterial leakage of mineral trioxide aggregate as a root-end filling material

*Torabinejad M, Rastegar AF, Kettering JD, Pitt Ford TR. Bacterial leakage of mineral trioxide aggregate as a root-end filling material. J Endodon 1995; 21:109-12.*

**PURPOSE:** To evaluate the ability of MTA as a root-end filling material to prevent bacterial leakage compared with amalgam, IRM, or Super-EBA.

**M&M:** Fifty single-rooted teeth were instrumented and the apical 3 mm of each root was removed at 90 degrees to the long axis. Four groups of 12 teeth each had 3 mm deep root-end fillings placed with the following materials: 1. Zinc-free amalgam (Sybraloy), 2. IRM, 3. Super-EBA, and 4. Mineral Trioxide Aggregate (MTA). The roots were coated with nail polish except for the resected root ends and the roots were suspended in phenol red lactose broth. *Staphylococcus epidermidis* was placed in the pulp chambers and canals and the time required for the bacteria to reach the broth (causing color change) was recorded.

**RESULTS:** There was no significant difference between median leakage times for amalgam (28.5 days), IRM (15 days), or Super-EBA (34.5 days). The MTA leaked significantly less than the other groups (90 days).

**C&C:** Torabinejad has previously shown that MTA leaks less than amalgam or Super-EBA using methylene blue dye, and that leakage with MTA did not seem to be significantly affected by moisture contamination. He relates some of these results to the hydrophilic nature of MTA which causes slight expansion when cured in a moist environment. However, biocompatibility and clinical longevity of this material have not been thoroughly evaluated.

**March 1995**

**Martin Gambill**

## Scanning electron microscopic evaluation of root-end preparations

*Gorman MC, Steinman HR, Gartner AH. Scanning electron microscopic evaluation of root-end preparations. J Endodon 1995;21:113-7.*

**PURPOSE:** To evaluate the topography of root-end cavities prepared with ultrasonic instrumentation, their smoothness and uniformity, and the presence of debris and the smear layer compared to conventional rotary bur root-end preparations.

**M&M:** Thirty extracted human incisors were accessed, instrumented, and obturated with laterally condensed gutta-percha. The apices were resected between 3 and 5 mm from the apex and beveled at a 45 degree angle. The teeth were divided into three experimental groups. The root ends were prepared to a depth of 3 mm with ultrasonics, conventional rotary instrumentation, or a combination of the two. The root-end preparations were examined under SEM. The preparations were evaluated for remaining debris and smear layer removal.

**RESULTS:** Cavities prepared with the combination technique showed significantly less debris than those prepared with rotary instruments alone. Cavities prepared with ultrasonics alone were not significantly different in remaining debris than the other two preparations techniques. Ultrasonics alone showed significantly less smear layer than the combined or rotary techniques and the combined technique showed significantly less smear layer than the rotary technique. Fractures were seen on the root face of many specimens. However, these were artifacts from the drying procedures.

**C&C:** Ultrasonic instrumentation produce very clean preparations, with reduced smear layer and surface debris.

March 1995

Bruce Poulsen

## Detection of interleukin-1 $\beta$ mRNA in rat periapical lesions

*Hamachi T, Anan H, Akamine A, Fujise O, Meada K. Detection of interleukin-1  $\beta$  mRNA in rat periapical lesions. J Endodon 1995; 21:118-21.*

**PURPOSE:** To localize and identify cells expressing interleukin-1 $\beta$  (IL-1 $\beta$ ) mRNA in experimentally induced periapical lesions in rats.

**M&M:** Apical periodontitis was produced in rats by opening the pulp chamber of left mandibular molars. The rats were killed after 3 days and cells expressing IL-1 $\beta$  mRNA were identified.

**RESULTS:** Morphologically the IL-1 $\beta$  mRNA-expressing cells were mononuclear and showed a round or oval shape and larger than neutrophils which is consistent with the features of macrophages.

**C&C:** IL-1 $\beta$  and IL-1 $\alpha$  both stimulate bone resorption, however IL-1 $\beta$  is reported to be the most potent. Wang and Stashenko found higher levels of IL-1 $\alpha$  than IL-1 $\beta$  in periapical lesions in their study in which lesions of longer duration were evaluated. The author proposes that the more potent IL-1 $\beta$  may be responsible for the early initiation of periapical lesion formation and that IL-1 $\alpha$  may contribute to later expansion of the lesion.

**March 1995**

**Martin Gambill**

## Experimental study of the biocompatibility of four root canal sealers and their influence of the zinc and calcium content of several tissues

*Economides N, Kotsaki-Kovatsi VP, Pouloupoulos A, Kolokuris I, Rozos G, Shore R. Experimental study of the biocompatibility of four root canal sealers and their influence of the zinc and calcium content of several tissues. J Endodon 1995;21:122-7.*

**PURPOSE:** To study the biocompatibility of four root canal sealers and the influence of the sealer ingredients on the concentrations of calcium and zinc of rate tissues.

**M&M:** Seventy-five rats were placed in five experimental groups. Teflon tubes with freshly mixed sealer were implanted into subcutaneous pockets. The sealers examined were AH-26, Roth 801, CRCS, and Sealapex. Empty tubes were placed as a control. The observation periods lasted 7, 14, and 21 d. The tubes and surrounding tissues were examined to determine the response to each sealer. Also, 25 animals were killed at 1 wk after implantation. The brain, kidneys, liver, and uterus were analyzed for zinc and calcium.

**RESULTS:** The most irritating material over the first observation period was AH-26, but the amount of irritation decreased over time. Roth 801 and Sealapex caused moderate-severe irritation throughout the experiment. The irritation caused by CRCS was moderate at day 7 and decreased over time. Significantly higher concentrations of zinc were found in animals in which Roth 801 or CRCS was implanted as compared to the other groups. Calcium concentration in the AH-26 treated animals was significantly increased and in the Roth 801 animals was significantly decreased as compared to other groups.

**C&C:** AH-26 releases formaldehyde and Roth 801 releases eugenol over time. These chemicals may be the cause of the irritation seen in this study. Both Roth 801 and CRCS sealer contain zinc which may possibly be leaching into the tissues over time. AH-26 does not contain calcium, but the reason for the increased calcium levels found in this study were not explained. The two sealers that contained calcium CRCS, Sealapex) did not show increased calcium levels.

**March 1995**

**Bruce Poulsen**

## Effects of lipopolysaccharides on human dental pulp cells

*Nakane A, Yoshida T, Nakata K, Horiba N, Nakamura H. Effects of lipopolysaccharides on human dental pulp cells. J Endodon 1995; 21:128-30.*

**PURPOSE:** To evaluate the effect of lipopolysaccharide complex (LPS) on human dental pulp cells by measurement of the DNA content, protein content, and alkaline phosphatase activity of the cells.

**M&M:** Human dental pulp cells were cultured and seeded into culture dishes. LPS samples prepared from Porphyromonas gingivalis, Porphyromonas endodontalis, and Fusobacterium nucleatum isolated from infected root canals and from Escherichia coli (positive control) were added to the pulp cell cultures at 1, 10 or 100 µg/ml concentrations. DNA content, protein content, and alkaline phosphatase activity of the pulp cells was determined up to 14 days.

**RESULTS:** In general, LPS from all of the bacteria at concentrations of 100 µg/ml inhibited DNA production while 10 µg/ml stimulated DNA production. LPS at 100 µg/ml inhibited protein production. LPS had no effect on alkaline phosphatase activity.

**C&C:** LPS has been found in concentrations from 1 to 100 µg/ml in infected root canals. LPS appears to have a cytotoxic effect at the higher concentrations which may be in part related to its ability to stop DNA and protein production. However, LPS may be most cytotoxic due to its stimulation of the release of cytokines from inflammatory cells.

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Martin Gambill

## Quantitative analysis of immunoglobulins and inflammatory factors in human pulpal blood from exposed pulps

*Nakanishi T, Matsuo T, Ebisu S. Quantitative analysis of immunoglobulins and inflammatory factors in human pulpal blood from exposed pulps. J Endodon 1995;21:131-6.*

**PURPOSE:** To establish a method for collecting pulpal blood samples from exposed pulps and to compare the levels of immunoglobulins, elastase, prostaglandin E2, and cytokines in clinically inflamed pulps with those found in normal pulps.

**M&M:** Thirty-six patients (9 normal pulps, 27 inflamed pulps) were used. The teeth were accessed and the blood from the exposed surface of the pulp was collected by one of four materials (nylon fiber, Teflon fiber, cotton wool, and glass wool). The amount of immunoglobulins, elastase, PGE2, IL-1a, IL-1b, IL-6, and TNF-a levels in the pulpal blood were determined.

**RESULTS:** The nylon fiber showed the best recovery in this blood collecting system. Statistically significant differences between normal and inflamed pulps were found in the levels of IgG, IgA, IgM, elastase, and PGE-2.

**C&C:** The elevated levels of immunoglobulins, elastase, and PGE-2 in pulpal blood could possibly serve as indicators of the inflammatory state of the pulp. PGE-2 seemed to be the most useful marker of pulpal inflammation and its levels might serve as a indicator of pulpal inflammation.

**March 1995**

**Bruce Poulsen**



## Histopathological observations of periapical repair in teeth with radiolucent areas submitted to two different methods of root canal treatment

*Leonardo MR, Almeida WA, Bezerra da Silva LA, Sabbag Utrilla L. Histopathological observations of periapical repair in teeth with radiolucent areas submitted to two different methods of root canal treatment. J Endodon 1995; 21:137-41.*

**PURPOSE:** To determine whether there were differences in the type and rate of repair as determined histologically between teeth with periapical radiolucencies that were treated using two methods.

**M&M:** Forty premolars in dogs were instrumented and left open for 1 week to create periapical lesions. For method 1 teeth were instrumented using 5.25% NaOCl alternated with 3% hydrogen peroxide. After preparation the teeth were filled with 14.3% EDTA for 3 min. and then irrigated with saline and dried. The canals were then filled with a paste containing calcium hydroxide, zinc oxide, powdered rosin, polyethylene glycol, and CMCP. After 7 days the paste was removed and the canals once again filled with EDTA for 3 min. and dried. The canals were then filled with GP and Sealapex sealer. For method 2 the same instrumentation methods were used, but 0.5% NaOCl was used with no hydrogen peroxide. No intracanal medication was used, and the canals were filled in a single visit. The dogs were killed after 9 months and evaluated histologically for healing of the periapical lesions.

**RESULTS:** In general, the teeth treated using method 1 showed signs of complete healing or were in the process of healing. The teeth treated using method 2 showed persistence of the lesions in 13 of 15 teeth. Areas of root resorption were evident in the teeth treated using method 2, and the inflammatory reactions was more severe in this group. Numerous microorganisms were found in dentinal tubules in the teeth treated using method 2.

**C&C:** The authors advocate aggressive irrigation with full strength NaOCl combined with hydrogen peroxide, and the use of an intracanal medicament (calcium hydroxide plus CMCP) for teeth with necrotic pulps and periapical lesions.

**March 1995**

**Martin Gambill**

## **Effect of dentin preparation and acid etching on the sealing ability of glass ionomer and composite resin when used to repair furcation perforations over plaster of Paris barriers**

*Himel VT, Alhadainy HA. Effect of dentin preparation and acid etching on the sealing ability of glass ionomer and composite resin when used to repair furcation perforations over plaster of Paris barriers. J Endodon 1995;21:142-5.*

**PURPOSE:** To evaluate the ability of dentin preparation and acid etching to improve the sealing ability of light-cured glass ionomer cement and composite resin when used to repair furcation perforations over plaster of Paris barriers.

**M&M:** Seventy extracted molars were accessed and perforated through the chamber floor with a #2 round bur. Plaster of Paris barriers were created in 60 of the teeth. The rest of the perforation was sealed with either light-cured glass ionomer (Vitrebond) or composite resin (XR V Herculite) with and without dentin etching. The teeth were placed in 2% methylene blue for 2 wk. Leakage was measured on each wall as linear dye penetration through the dentin-material interface.

**RESULTS:** All experimental groups demonstrated dye penetration to varying degrees. The perforations repaired with composite resin showed more leakage than those perforations repaired with glass ionomer. Teeth repaired with composite resin without dentin preparation or acid etching showed leakage of 98.6% of the perforation walls, composite resin with dentin preparation showed leakage of 82% of the perforation walls. The teeth repaired with glass ionomer without dentin preparation or acid etching showed leakage of 55.7% of the perforation walls, glass ionomer with dentin preparation showed leakage of 32% of the perforation walls.

**C&C:** The better sealing ability of glass ionomer as compared to composite resin may be due to the glass ionomer's ability to flow into the apical end of the perforation. No matter what method was used, there was still a large amount of leakage with all materials tested.

**March 1995**

**Bruce Poulsen**

## **A comparison of root canal preparations using Ni-Ti hand, Ni-Ti engine-driven, and K-flex endodontic instruments**

*Glosson CR, Haller RH, Dove SB, del Rio CE. A comparison of root canal preparations using Ni-Ti hand, Ni-Ti engine-driven, and K-flex endodontic instruments. J Endodon 1995; 21:146-51.*

**PURPOSE:** To compare root canal preparations produced by five endodontic instruments: stainless steel K-files, nickel-titanium (Ni-Ti) hand files (Mity file), Ni-Ti engine-driven files (NT Sensor), Ni-Ti Canal Master (CMU) hand instruments, and Ni-Ti engine-driven Lightspeed instruments.

**M&M:** Thirty mesial roots of mandibular molars with curvatures between 15 and 31 degrees were mounted in resin blocks and sectioned 2 mm from the apex and at a point 1 mm apical to the point at which the canal began to deviate from a straight line. The Bramante technique was used to reposition the sections for instrumentation. Five groups with 12 canals in each group were compared. Canals in the K-Flex, and Mity file (Ni-Ti) groups were preflared and instrumented using a quarter turn-pull technique. Canals in the CMU group were instrumented using a technique developed at the University of Texas Health Science Center at San Antonio. NT Sensor, and Lightspeed groups were instrumented according to the manufacturers recommended technique. In all groups the canals were first enlarged to a size #30 file 0.5 mm short of the canal length, then instrumented to a size #45 apical size followed by 1 mm stepback preparation to a size #60. The sections were initially imaged using a video camera system, and digitized images of the sections were stored on optical disks. Additional images were made of the sections after filing to an apical size #30 file and again after final preparation (apical size #45). The digitized images were compared using a digital subtraction software program to determine transportation, amount of dentin removed, centering ratio, and canal curvature. Time required for instrumentation was also compared for the different techniques.

**RESULTS:** In general the Ni-Ti engine driven instruments (Lightspeed and NT Sensor) and the CMU hand instrument showed less transportation, better centering, and less dentin removal than the K-Flex and Mity File hand instruments in most sections. The Mity Files showed less transportation than K-Flex files in the mid-root sections. Preparation time for the NT Sensor and Lightspeed instruments was significantly faster than the hand instrumentation methods.

**C&C:** Ni-Ti engine driven instruments appear to have many desirable properties which may improve our ability to instrument canals more efficiently.

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**Martin Gambill**

## **Influence of plugger penetration on sealing ability of vertical condensation**

*Yared GM, Bou Dagher FE. Influence of plugger penetration on sealing ability of vertical condensation. J Endodon 1995;21:152-3.*

**PURPOSE:** To compare the sealing ability of the vertical condensation obtained with different levels of plugger penetration.

**M&M:** Ninety human anterior teeth were accessed, instrumented, and obturated with vertical condensation of warm gutta-percha. The deepest level of plugger penetration was 5, 7, or 9 mm short of the working length. The amount of microleakage was measured by fluid filtration at 1.5 h, 1 d, 1, 4, 12, 18, and 24 wk.

**RESULTS:** There was a trend toward increased microleakage over time for all groups. The teeth with plugger penetration to within 9 mm of the working length had significantly greater leakage than the other two groups at all time intervals.

**C&C:** Deeper plugger penetration required deeper penetration by the heat carrier. Therefore, heat was transferred to the apical area which increased gutta-percha softening and probably resulted in a better apical seal.

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**Bruce Poulsen**

## Canal blockage and debris extrusion with eight preparation techniques

*Al-Omari MAO, Dummer PMH. Canal blockage and debris extrusion with eight preparation techniques. J Endodon 1995; 21:154-8.*

**PURPOSE:** To quantitatively compare amounts of debris extruded apically in vitro from extracted human teeth using eight preparations techniques. Permanent blockages produced within canals as a result of compaction of debris were also evaluated.

**M&M:** A total of 208 roots were prepared with one of the following instrumentation techniques: 1. Standardized technique, 2. Stepback technique using a reaming motion, 3. Stepback technique using circumferential filing, 4. Stepback technique with anticurvature filing, 5. Double-flared technique, 6. Step-down technique, 7. Crown-down pressureless technique, and 8. Balanced Force technique. The dry weight of the extruded debris was measured and compared for each group. Canal blockages during preparation were also noted.

**RESULTS:** Blockage occurred in 51 of the 208 roots. Most blockages occurred using anticurvature or circumferential filing techniques or in the double-flared technique group. Few blockages occurred in groups in which orifice enlargement or a reaming action were used. Also, the greatest weight of debris extrusion occurred in the anticurvature, circumferential, and double-flared technique groups.

**C&C:** This study supports instrumentation techniques which use early coronal enlargement and reaming motions since less debris extrusion and less canal blockage was found in groups using these techniques.

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**Martin Gambill**

## Coronal leakage and treatment failure

*Chong BS. Coronal leakage and treatment failure. J Endodon 1995;21:159-60.*

**CASE REPORT:** A 43-yr-old woman had experienced a toothache in her maxillary left lateral incisor. Root canal treatment was started, but the symptoms worsened. The tooth was reopened and redressed. The symptoms remained. Composite resin restorations were on both the mesial and distal. Upon closer inspection, caries was noted under the margins of these restorations. Coronal microleakage was considered to be the most likely cause of the patient's continued discomfort. The deficient restorations and caries were removed and the tooth sealed. Seventeen days later the patient was asymptomatic and the canal was obturated.

**C&C:** This case stresses the importance of ensuring that existing coronal restorations of the tooth under treatment are sound and caries free. The integrity of the coronal seal is of vital importance since coronal microleakage may jeopardize the success of root canal treatment.

**March 1995      Bruce Poulsen**